# Treatment, Alcoholics Anonymous, and 16-Year Changes in Impulsivity and Legal Problems Among Men and Women With Alcohol Use Disorders*

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**ABSTRACT. Objective:** The link between impulsive personality traits and alcohol use disorders (AUDs) is well established. No studies, however, have investigated whether receipt of help for AUDs predicts change in impulsivity or whether such change is associated with relevant outcomes such as legal problems. The present study examined predictive associations between the duration of help for AUDs (Alcoholics Anonymous [AA], professional treatment) and impulsivity and legal problems over 16 years in men and women with AUDs. **Method:** Participants who were initially untreated for their AUDs ($n_{men}$ = 332, $n_{women}$ = 296) completed follow-up telephone interviews at 1 and 16 years after their baseline assessment. **Results:** Impulsivity and legal problems declined between baseline and the 1-year and 16-year follow-ups among both women and men. A longer duration of participation in AA predicted a decline in impulsivity at both follow-up assessments, and, in turn, a decline in impulsivity predicted a decline in legal problems at Years 1 and 16. In addition, a longer duration of participation in AA predicted fewer legal problems at Year 1, and this association was moderated by gender (significant in men) and impulsivity (significant for individuals with higher baseline scores). **Conclusions:** The results highlight the potential for AA and professional treatment to reduce the expression of impulsivity and related disinhibitory traits and legal problems in individuals with AUDs. (*J. Stud. Alcohol Drugs* **70:** 714-725, 2009)

IMPULSIVITY AND RELATED PERSONALITY traits of disinhibition reflect tendencies to engage in a pattern of behavior marked by risk taking, poor self-control, and lack of planning and forethought. Such traits are core risk factors for a range of psychopathology (Moeller et al., 2001a), including substance use disorders such as alcoholism (e.g., Dolan et al., 2008; Sher et al., 1999). Moreover, "impulsivity or failure to plan ahead" is included in the diagnostic criteria for Antisocial Personality Disorder from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (American Psychiatric Association, 2000) and represents one of the strongest personality correlates of criminal behavior (Krueger et al., 1994). Despite its prominence as a risk factor for these conditions, few studies have examined whether formal or informal types of help can affect change in impulsivity. Furthermore, what research does exist has focused on pharmacologic rather than psychosocial interventions (Moeller et al., 2001a).

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In the present investigation, we focused on men and women with alcohol use disorders (AUDs), untreated at baseline, to determine whether receipt of help for their alcohol problems (i.e., Alcoholics Anonymous [AA] or professional treatment) was associated with changes in impulsivity and legal problems 1 year and 16 years after baseline. In addition, we examined associations between changes in impulsivity after 1 year and 16 years and changes in the occurrence of legal problems over these periods.

### *Change in impulsivity and participation in AA and treatment*

There is a well-established association between personality characteristics related to impulsivity and AUDs (e.g., McGue et al., 1999; Scourfield et al., 1996; Sher et al., 1999). Impulsivity tends to be higher among early-onset than late-onset alcoholics (Dom et al., 2006) and among individuals in treatment for substance use disorders, compared with the general population (Cherpitel, 1999; Conway et al., 2002). Moreover, impulsive personality traits often precede the onset of AUDs and predict alcohol-related problems prospectively (Caspi et al., 1997; Cloninger et al., 1988; Elkins et al., 2006; Sher et al., 2000). In addition, links between impulsivity and alcohol use history are comparable among current drinkers and remitters, suggesting that the association is not simply a self-report bias due to changes in psychiatric state from chronic substance use (Conway et al., 2002).

Based on this robust association, several studies have investigated impulsivity as a static risk factor affecting the course of substance use treatment (e.g., Moeller et al., 2001b; Poling et al., 2007). However, to our knowledge, no studies to date have considered the potential of treatment to change impulsivity. This gap in the literature may stem from an assumption that personality traits are stable constructs in adulthood and thus relatively impervious to change. Such a notion is supported by evidence of increasing rank-order stability in personality across the life span—or continuity in the relative ordering among individuals in a population over time (Roberts and DelVecchio, 2000). However, traits related to impulsivity exhibit significant mean- and individual-level declines in early adulthood and gradually decrease thereafter throughout adulthood (e.g., Blonigen et al., 2008; Donnellan et al., 2007; Roberts et al., 2001, 2006). Similar declines have been reported for symptoms of personality disorders that include impulsivity as a core feature (Clark, 2005; Lenzenweger et al., 2004). Furthermore, relationship and work experiences that press for increased responsibility and conscientiousness predict decreases in personality traits related to impulsivity (Roberts, 1997; Roberts et al., 2003; Robins et al., 2002).

In essence, personality traits such as impulsivity represent both stable *and* dynamic constructs that are subject to change and adaptation over the life course (Caspi et al., 2005). Given the impact of changes in life circumstances on personality, both formal and informal therapeutic interventions may influence individual levels of impulsivity. For example, formal therapeutic interventions and self-help groups for AUDs (e.g., AA) tend to bolster self-efficacy; increase a reliance on approach as compared with avoidance coping; and encourage greater structure, organization, and planning in life (Moos, 2008; Morgenstern et al., 1997). Such mechanisms of action could reduce individuals' propensity to engage in impulsive behavior and thereby lead to a decline in impulsivity.

The present study focused on mean-level changes in impulsivity in a sample of individuals with AUDs and examined the extent to which participation in AA and treatment is associated with change in impulsivity. Of note, previous studies with community-based samples have reported higher mean levels of impulsivity in men than in women, as well as a greater change in impulsivity over time among women than among men (Blonigen et al., 2008; Roberts et al., 2001). Accordingly, we used our mixed-gender sample to examine whether gender moderated mean-level change in impulsivity and the association between receipt of help and impulsivity.

### *Change in impulsivity, participation in AA and treatment, and change in legal problems*

In addition to impulsivity, AUDs are closely linked to a host of behaviors that bring individuals to the attention of the legal system, such as property crime, assault, and driving under the influence (LaBrie et al., 2007; Leonard and Quigley, 1999; Rosen et al., 2008). Although the extent to which this relationship is causal has been debated (Parker and Auerhahn, 1998), there is some evidence that receipt of help may reduce criminal outcomes among individuals with AUDs. For example, in a longitudinal study of a Canadian population-based sample, Mann et al. (2006) reported a negative relationship between AA membership and homicide mortality rates in men (but not in women). Moreover, individuals in treatment for drug addiction, or for substance use problems more generally, have been shown to improve on legal outcomes using either 12-step or formal interventions (McLellan et al., 1986; Ouimette et al., 1997, 1998). In accordance with these studies, we examined the connection between the duration of participation in AA and professional treatment and changes in legal problems among women and men, as well as potential moderation of this relationship via gender.

As with AUDs, impulsive personality traits are strongly linked to indices of crime (Caspi et al., 1994; Krueger et al., 1994) and have been shown to predict criminal behavior prospectively in longitudinal studies (Elkins et al., 1997). Furthermore, risk-taking dispositions correspond to a higher likelihood of violence among individuals in treatment for alcohol and other drugs (MacDonald et al., 2008). Given this link between impulsivity and crime, we sought to examine the role of impulsivity as a moderator in the relationship between the receipt of help and legal problems and the extent to which changes in impulsivity are associated with changes in legal problems. This latter question is crucial because it provides a test of whether individuals' perception of change in their impulsive tendencies has implications for other outcomes that are theoretically and empirically linked to these traits.

### *Current study*

In the current study, we investigated the association between the duration of participation in AA and professional treatment and impulsivity and legal problems over the course of 16 years in men and women with AUDs. The data were drawn from a larger study that evaluated the influence of professional treatment and AA on individuals' abstinence and other alcohol-related outcomes (Moos and Moos, 2006). The work described here extends this prior work by (1) assessing the degree of change in impulsivity and legal problems over 16 years, (2) assessing the connection between the duration of participation in AA and treatment and impulsivity and legal problems over this period, and (3) investigating whether changes in impulsivity predict changes in legal problems.

Based on past longitudinal research, we expected impulsivity and legal problems to decline over time. In terms of the impact of AA and treatment on impulsivity, although

there are no treatment-outcome studies on which to base hypotheses, given the impact of formative life experiences on personality (e.g., Robins et al., 2002), we hypothesized that a longer duration of participation in either AA or treatment would be associated with a decline in impulsivity. In turn, we expected declines in impulsivity to be associated with fewer legal problems.

## Method

### *Sample and procedure*

Participants were men and women with AUDs who, at baseline, had not received professional treatment for their substance use problems. Individuals had an initial contact with alcohol treatment services through an information and referral center or a detoxification program. All potential participants were screened by on-site staff to verify their eligibility. A total of 628 individuals were deemed eligible based on (1) lack of previous substance use treatment and (2) an AUD as determined by one or more substance use problems, dependence symptoms, drinking to intoxication in the past month, and/or perception of alcohol use as a significant problem. After providing informed consent, participants completed a baseline inventory assessing their substance use and psychosocial functioning.

Following the baseline assessment, participants were contacted by telephone after 1 year and 16 years and were asked to complete an inventory that was essentially identical to the baseline measure. Of the 628 participants at baseline, 515 participated in the Year 1 follow-up assessment (82.0%). At the 16-year follow-up, 121 individuals of the original 628 (19.3%) were known to have died. Of the remaining 507 individuals, 405 individuals (79.9%) completed the 16-year follow-up.

The 628 participants at baseline consisted of 332 men (52.9%) and 296 women (47.1%), the majority of whom were white (81.4%), not married (79.0%), and unemployed (59.6%). The mean (SD) age of these participants at baseline was 34.7 (9.4) years (range: 18-68). Further information on the sociodemographic characteristics of the sample and other details on the initial data-collection process are described in Timko et al. (1993).

### *Measures*

*Impulsivity.* Impulsivity was assessed at all time points using the 10-item impulsivity scale from the Differential Personality Inventory (Jackson and Messick, 1986). Respondents rated items on a 4-point scale (1 = strongly disagree, 4 = strongly agree) that reflected their level of agreement with statements regarding impulsive behavior and risk taking (e.g., "I believe I act more impulsively than do most people") or lack of planning (e.g., "I like to do things on the spur of the moment"). Items were coded such that higher scores denoted greater self-reported impulsivity. Internal consistencies, based on Cronbach's alpha, were satisfactory at all time points (baseline = .74; Year 1 = .73; Year 16 = .73).

*Participation in AA and professional treatment.* At each follow-up assessment, participants were asked whether they had participated in AA or received professional treatment for their drinking habits or drinking-related problems since baseline. Participants who responded in the affirmative were asked to report on the duration (i.e., the number of weeks) for each episode of help. The total number of weeks of participation in AA and (separately) in professional treatment was summed across each episode of help between baseline and Year 1 and between baseline and Year 16. Because professional treatment programs often include AA participation as a component of their intervention protocols, participants were specifically instructed to report on each type of help separately. Empirical support for the reliability and validity of self-reported participation in AA and substance use disorder treatment has been previously reported (Adair et al., 1996; Tonigan et al., 2002).

For the 515 participants who were followed at Year 1, the mean number of weeks in AA and professional treatment were 15.4 (19.2) and 12.9 (20.2), respectively. For the 405 participants who were followed at Year 16, the mean number of weeks in AA and professional treatment from baseline to Year 16 were 97.2 (140.8) and 46.6 (72.6), respectively. The duration variables for AA and professional treatment were positively skewed; however, raw scores were used in all analyses because results were comparable when using either log-transformed or untransformed variables. In terms of gender differences, from baseline to Year 1, men and women did not differ significantly in the duration in AA. However, women reported a slightly longer duration in professional treatment over this period ($F$ = 5.07, 1/513 df, $p$ = .03; $d$ = 0.20). From baseline to Year 16, women also reported a slightly longer duration in both AA ($F$ = 5.68, 1/403 df, $p$ = .02; $d$ = 0.24) and professional treatment ($F$ = 6.09, 1/403 df, $p$ = .01; $d$ = 0.25).

*Legal problems.* At each assessment, participants were asked to rate how often, on a 5-point scale (0 = never, 4 = often), they had experienced problems as a result of their drinking in the past 6 months (Moos et al., 1990). Three items related to "drinking-related legal problems" were measured (i.e., hit someone due to drinking; police trouble due to drinking; driving while intoxicated). These items are similar to those included in the National Alcohol Survey. The mean intercorrelations among these items at baseline, Year 1, and Year 16 were .31, .51, and .31, respectively.

In addition, participants answered three dichotomous items (rated "yes" or "no") pertaining to various "criminal matters" they might have experienced in the past year (i.e., personally assaulted, trouble with the law [other than minor traffic violations], put in jail). The prevalence of these events

at baseline, Year 1, and Year 16 were as follows: personally assaulted = 13.8%, 7.2%, and 6.9%, respectively; trouble with the law = 31.7%, 16.7%, and 12.8%, respectively; and put in jail = 32.7%, 17.7%, and 13.1%, respectively. Mean intercorrelations among these items at baseline, Year 1, and Year 16 were .38, .34, and .43, respectively.

Given their similarity in content, we combined the three items related to drinking-related legal problems and the three items related to criminal matters in a principal component analysis to yield scores on a broad outcome variable of *legal problems.* Principal component analyses yielded a single, dominant component accounting for 48.8% and 44.4% of the total variance across the six items at Years 1 and 16, respectively.

*Pattern of drinking.* At the baseline and follow-up assessments, participants were asked to rate their pattern of drinking in the past month on a 6-point scale (1 = did not drink at all, 2 = light drinking, 3 = moderate drinking, 4 = fairly heavy drinking, 5 = very heavy drinking, and 6 = occasional drinking "binges" [i.e., heavy episodic drinking]). Scores on this item at each assessment were used to compute change scores indicating declines in drinking over time. At the baseline, Year 1, and Year 16 assessments, the mean ratings for this item were 4.11 (1.39), 2.20 (1.43), and 1.89 (1.17), respectively.

### *Attrition analyses*

To test for biases due to attrition, we compared participants and nonparticipants at Years 1 and 16 on their scores for impulsivity and legal problems at baseline. The two groups did not differ significantly in impulsivity at either follow-up assessment (Year 1: $F = 1.83$, 1/625 df, NS; $d = 0.14$; Year 16: $F = 0.67$, 1/625 df, NS; $d = 0.07$). In terms of legal problems, Year 1 nonparticipants had slightly more problems at baseline than participants ($F = 5.14$, 1/619 df, $p < .05$; $d = 0.22$). There was no difference, however, between participants and nonparticipants at the 16-year follow-up ($F = 0.00$, 1/619 df, NS; $d = 0.00$). Thus, participants at the follow-up assessments appear to be representative of the original sample in terms of impulsivity and legal problems.

### *Data analysis*

Analyses began with an assessment of mean-level changes over 16 years in impulsivity and legal problems among men and women. We used a two-factor repeated measures analysis of variance (RM-ANOVA; a within-group factor of time and a between-group factor of gender) to assess the main effects of time, gender, and the Time × Gender interaction. For the main effect of time, we report effect sizes using Cohen's *d* statistic (Cohen, 1988), which illustrates the magnitude and direction of change in these variables over time in SD units.

Next, we examined the associations between the duration of help and impulsivity at the 1- and 16-year follow-ups using multiple regressions. In Step 1, after controlling for covariates (see below), impulsivity at baseline was entered into the model to evaluate rank-order stability in these traits over 1 and 16 years. In Step 2, variables reflecting the duration of AA and professional treatment were added (separately) into the model to assess their ability to predict changes in impulsivity from baseline to Year 1, Year 1 to Year 16, and baseline to Year 16. In Step 3, zero-centered interaction terms between gender and the duration of help variables were entered into the model to examine the moderating role of gender in the association between the receipt of help and impulsivity across time.

In the final set of analyses, we focused on the relationship between the receipt of help, impulsivity, and legal problems over time. Specifically, using multiple regressions, we examined whether the duration of help and changes in impulsivity from baseline to Year 1, Year 1 to Year 16, and baseline to Year 16 were associated with changes in legal problems over these periods. Impulsivity change scores at Year 1 were computed by subtracting scores at Year 1 from baseline ($\text{Impulsivity}_{\text{baseline}} - \text{Impulsivity}_{\text{Year 1}}$) such that higher scores indicate a greater decline in impulsivity over this period. Impulsivity change scores from Year 1 to Year 16 ($\text{Impulsivity}_{\text{Year 1}} - \text{Impulsivity}_{\text{Year 16}}$) and from baseline to Year 16 ($\text{Impulsivity}_{\text{baseline}} - \text{Impulsivity}_{\text{Year 16}}$) were computed in similar fashion. Finally, we explored whether gender or impulsivity at baseline (zero-centered) moderated the relationship between the duration of help and legal problems at the 1- and 16-year follow-ups.

## Results

### *Intercorrelations at baseline: Men and women*

Table 1 provides intercorrelations (computed separately by gender) between impulsivity, legal problems, and several demographic variables at baseline, and duration of AA and professional treatment between baseline and the 1-year follow-up. Impulsivity and legal problems were positively correlated in both men and women. Older age, more education, and marital status were associated with less impulsivity and fewer legal problems in men and women. Duration of AA and professional treatment between baseline and 1 year were modestly positively correlated in both genders. Duration of AA and professional treatment was generally uncorrelated with the baseline measures, with the exception of positive associations with impulsivity in men and with education in both men and women.

Demographic variables of income and employment also were examined in relation to impulsivity and legal problems and were weakly (albeit significantly) correlated with these measures. However, after controlling for age, education,

TABLE 1. Intercorrelations between baseline impulsivity, legal problems, and demographics, and help-related variables over 1-year

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Impulsivity | – | .19† | -.14† | -.22† | -.16† | .16† | -.06 |
| 2. Legal problems | .34† | – | -.23† | -.29† | -.10 | .08 | .08 |
| 3. Age | -.34† | -.33† | – | .12* | .20† | .10 | .10 |
| 4. Education | -.23† | -.27† | .22† | – | .12* | .05 | .24† |
| 5. Marital status | -.26† | -.21† | .14* | .08 | – | .00 | .01 |
| 6. AA | .06 | .04 | -.03 | .11 | -.05 | – | .19† |
| 7. Treatment | -.05 | .01 | .07 | .18† | -.09 | .25† | – |

*Notes:* Correlations for men are above the diagonal. Correlations for women are below the diagonal. $n_{Men}$ = 330-332, $n_{women}$ = 285-296. Legal problems = component scores based on a principal components analysis of six items. Alcoholics Anonymous (AA) and treatment were measured from baseline to 1 year.
*$p < .05$; †$p < .01$.

and marital status, income and employment were no longer significantly related to these measures. Thus, income and employment were not included as covariates in subsequent analyses.

### *Mean-level change in impulsivity and legal problems over 16 years*

Table 2 provides the results from the RM-ANOVAs assessing mean-level change in impulsivity and legal problems. Analyses were conducted with raw scores. However, to facilitate interpretation of the magnitude of effects, raw scores were transformed into *T* scores at baseline (mean = 50 [10]) across the total sample. *T* scores at Years 1 and 16 were computed after standardizing the baseline scores. Effect sizes (*d* scores) are presented for time intervals of baseline to Year 1 (Time 1 [T1]), Year 1 to Year 16 (T2), and baseline to Year 16 (T3). Given prior evidence of age-related declines in impulsivity (Roberts et al., 2006) and criminality (Blumstein et al., 1988), age was included as a covariate in these analyses.

For impulsivity, the main effect of time was highly significant, with effect sizes revealing a substantial decrease across all time intervals for both men and women. Neither the main effect of gender nor the Time × Gender interaction was significant. Thus, men and women exhibited similar levels of impulsivity across the 16-year period and declined on this trait at a comparable rate. Legal problems also declined significantly over time. In contrast to impulsivity, the main effect of gender was significant, with follow-up univariate tests revealing more legal problems for men than for women at all time points (*p*s < .05). The Time × Gender interaction was nonsignificant, however, indicating that men and women declined at a similar rate over time on these problems.

### *Help-related predictors of impulsivity at Years 1 and 16*

Results from multiple regressions evaluating the association between the duration of AA and professional treatment and impulsivity at the 1- and 16-year follow-ups are presented in Table 3. In Step 1, after several covariates (i.e., age, gender, education, and marital status) were controlled for, impulsivity at baseline was strongly associated with impulsivity at both Year 1 and Year 16.

For Step 2, after baseline demographics and impulsivity at baseline were controlled for, longer duration of participation in AA and professional treatment from baseline to Year 1 was associated with a decline in impulsivity over this period. At Year 16, this finding was robust for AA duration, which was associated with a decline in impulsivity from Year 1 to Year

TABLE 2. Mean-level change in impulsivity and legal problems over 16 years in men and women with alcohol use disorders

| | | | | | | | *F* tests | | |
|---|---|---|---|---|---|---|---|---|---|
| | Baseline | Year 1 | Year 16 | Change over time (*d*) | | | | | Time × |
| Variable | Mean (SD) | Mean (SD) | Mean (SD) | T1-T2 | T2-T3 | T1-T3 | Time | Gender | Gender |
| Impulsivity | | | | | | | 19.90† | 1.50 | 2.28 |
| Total | 50.0 (10.0) | 46.7 (9.2) | 44.4 (9.3) | -.38† | -.22† | -.60† | | | |
| Men | 49.0 (9.7) | 46.5 (9.1) | 43.9 (9.1) | -.27† | -.30† | -.56† | | | |
| Women | 51.1 (10.2) | 46.9 (9.2) | 44.9 (9.4) | -.49† | -.15* | -.63† | | | |
| Legal problems | | | | | | | 29.15† | 16.52† | 0.28 |
| Total | 50.0 (10.0) | 43.5 (7.8) | 41.7 (5.4) | -.73† | -.28† | -1.07† | | | |
| Men | 50.8 (10.2) | 44.5 (8.6) | 42.6 (6.2) | -.74† | -.21* | -1.00† | | | |
| Women | 49.1 (9.7) | 42.4 (6.7) | 40.8 (4.3) | -.74† | -.37† | -1.17† | | | |

*Notes:* Age included as a covariate in all analyses. $n_{Total}$ = 345-349; $n_{Men}$ = 165-166; $n_{Women}$ = 180-183 (sample sizes based on listwise deletion across time). T = Time; T1-T2 = baseline-Year 1; T2-T3 = Year 1-Year 16; T1-T3 = baseline-Year 16.
*$p < .05$; †$p < .01$.

TABLE 3. Duration of Alcoholics Anonymous (AA) and treatment as predictors of impulsivity at Years 1 and 16

| Predictors | Impulsivity | |
|---|---|---|
| | Year 1 (β) | Year 16 (β) |
| Step 1 (controlling for baseline demographics) | | |
| Impulsivity (baseline) | .48† | .49† |
| Step 2 (one of the following) | | |
| Baseline-Year 1 | | |
| AA | -.09* | – |
| Treatment | -.08* | – |
| Year 1-Year 16 | | |
| AA | – | -.13† |
| Treatment | – | .02 |
| Baseline-Year 16 | | |
| AA | – | -.12† |
| Treatment | – | .01 |
| Step 3 (one of the following corresponding to Step 2) | | |
| Baseline-Year 1 | | |
| AA × Gender | .04 | – |
| Treatment × Gender | .01 | – |
| Year 1-Year 16 | | |
| AA × Gender | – | .00 |
| Treatment × Gender | – | -.02 |
| Baseline-Year 16 | | |
| AA × Gender | – | .02 |
| Treatment × Gender | – | .02 |

*Notes:* Baseline demographics controlled for in Step 1: age, gender, education, marital status. AA and treatment refer to duration (number of weeks) of help.

16 and from baseline to Year 16. Duration of professional treatment was not associated with a decline in impulsivity from either Year 1 to Year 16 or from baseline to Year 16. For both AA and professional treatment, interaction terms with gender were nonsignificant at both follow-up assessments. In subsidiary analyses, the unique effects of AA and professional treatment were investigated and found to be comparable to the findings in which these predictors were examined separately.

To assess the possibility that declines in alcohol use, rather than the receipt of help, per se, may account for changes in impulsivity over time, we performed additional regression analyses that included "drinking pattern" change scores as predictors of impulsivity at Years 1 and 16. After entering these change scores into the model, the effects of the duration of AA and professional treatment remained significant. In sum, after accounting for impulsivity at baseline as well as changes in drinking patterns over time, longer duration of AA was associated with a decline in impulsivity in men and women across all periods of assessment.

### *Help-related predictors of legal problems at Years 1 and 16*

After establishing that impulsivity and legal problems declined over 1 and 16 years and that longer duration of AA, and to some extent professional treatment, were linked to declines in impulsivity over these periods, we focused on the connections among these variables at each follow-up assessment. Specifically, we examined (1) whether changes in impulsivity were associated with changes in legal problems, (2) whether the duration of help was associated with changes in legal problems, and (3) whether gender or impulsivity moderated the associations between the duration of help and legal problems.

Table 4 lists the results of multiple regression analyses with legal problems at Years 1 and 16 as the criterion. Step 1 controlled for baseline covariates and baseline values of legal problems and impulsivity. In Step 2, impulsivity change scores were entered into the model, with high scores signifying a *decline* in impulsivity over time. At Year 1, greater declines in impulsivity were associated with greater declines in legal problems; this finding held when changes in drink-

TABLE 4. Duration of Alcoholics Anonymous (AA) and treatment, and decline in impulsivity as predictors of legal problems at Years 1 and 16

| Predictors | Legal problems | |
|---|---|---|
| | Year 1 (β) | Year 16 (β) |
| Step 1 (controlling for baseline demographics) | | |
| Legal problems (baseline) | .27† | .15† |
| Impulsivity (baseline) | .07 | .10 |
| Step 2 (one of the following) | | |
| Baseline-Year 1 | | |
| Decline in impulsivity | -.19† | – |
| AA | -.14† | – |
| Treatment | -.05 | – |
| Year 1-Year 16 | | |
| Decline in impulsivity | – | -.11* |
| AA | – | -.08 |
| Treatment | – | .04 |
| Baseline-Year 16 | | |
| Decline in impulsivity | – | -.15† |
| AA | – | -.06 |
| Treatment | – | .04 |
| Step 3 (one of the following corresponding to Step 2) | | |
| Baseline-Year 1 | | |
| AA × Gender | .12* | – |
| Treatment × Gender | .05 | – |
| AA × Impulsivity | -.12† | – |
| Treatment × Impulsivity | -.07 | – |
| Year 1-Year 16 | | |
| AA × Gender | – | -.09 |
| Treatment × Gender | – | -.09 |
| AA × Impulsivity | – | -.03 |
| Treatment × Impulsivity | – | .01 |
| Baseline-Year 16 | | |
| AA × Gender | – | -.14 |
| Treatment × Gender | – | -.10 |
| AA × Impulsivity | – | -.03 |
| Treatment × Impulsivity | – | -.01 |

*Notes:* Baseline demographics controlled for in Step 1: age, gender, education, marital status. Decline in impulsivity = higher scores indicate a decrease in impulsivity over time. Impulsivity scores for the interaction terms were measured at baseline.
*$p < .05$; †$p < .01$.

ing between baseline and Year 1 were accounted for. At Year 16, declines in impulsivity also predicted declines in legal problems from Year 1 to Year 16 and from baseline to Year 16. After changes in drinking were accounted for, the effect for the decline in impulsivity from baseline to Year 16 held, but the effect for the decline in impulsivity from Year 1 to Year 16 was reduced to nonsignificance.

Results from Step 2 also demonstrate the connection between the duration of help and changes in legal problems. Longer duration of AA between baseline and Year 1 was associated with fewer legal problems at Year 1 and remained significant after declines in drinking over this time frame were accounted for. At Year 16, longer duration of AA did not significantly predict changes in legal problems from Year 1 to Year 16 or from baseline to Year 16. Professional treatment was not significantly related to legal problems at either time. When we examined the unique effects of AA and professional treatment on legal problems, we found that the results were essentially the same as in the main analyses in which these predictors were examined separately.

In Step 3, we investigated the possibility that gender or (baseline) impulsivity moderated the associations between the duration of help and legal problems. At Year 1, interactions between the duration of AA and both gender and impulsivity were significant. For the gender interaction, conditional moderators (Holmbeck, 2002) conducted separately within gender indicated that the association between the duration of AA and the change in legal problems was

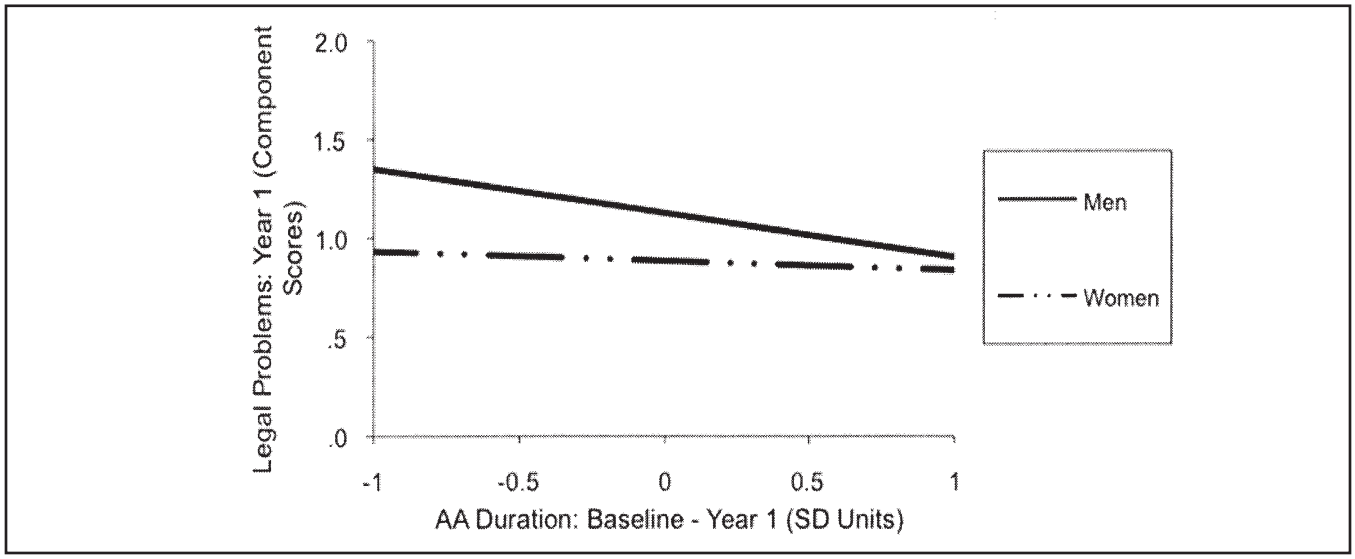


FIGURE 1. Interaction between gender and Alcoholics Anonymous (AA) duration in the prediction of legal problems at Year 1

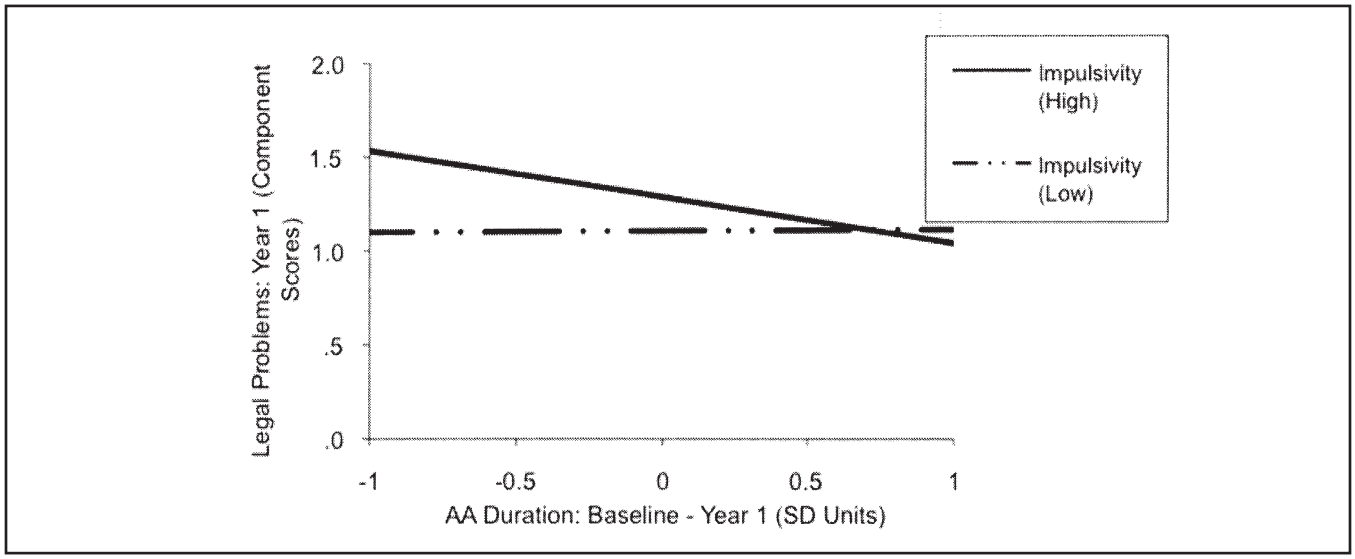


FIGURE 2. Interaction between impulsivity and Alcoholics Anonymous (AA) duration in the prediction of legal problems at Year 1

significant for men (β = -.22, $p < .01$) but not for women (β = -.05, $p = .39$). This interaction is plotted in Figure 1. With respect to the interaction with impulsivity, conditional moderators revealed that there was a significant association between the duration of AA and a decline in legal problems for individuals who were high (+1 SD: β = -.25, $p < .01$) but not for those who were low (-1 SD: β = .01, $p = .90$) on impulsivity at baseline (see Figure 2). At Year 16, none of the interaction terms were significant.

## Discussion

To our knowledge, the present study is among the first to examine associations over time between participation in AA and treatment, impulsive personality traits, and legal problems in a mixed-gender sample of individuals with AUDs. Impulsivity and legal problems declined in both men and women between baseline and the 1- and 16-year follow-ups. At both follow-up time points, men and women who attended AA longer declined more in impulsivity. In turn, greater declines in impulsivity were associated with fewer legal problems at Years 1 and 16. A longer duration of AA attendance was associated with fewer legal problems at Year 1. This association was moderated by gender and impulsivity, such that it held more strongly among men than among women, and among individuals high rather than low in impulsivity.

### *Mean-level declines in impulsivity: Potential mechanisms of action*

We obtained evidence for both stability and change in impulsivity among individuals with a history of AUDs. Consistent with prior work (Roberts and DelVecchio, 2000), impulsivity scores at baseline were highly and comparably correlated with impulsivity scores at Years 1 and 16. Thus, relative to one another, individual levels of impulsivity were fairly stable over these periods. Across the sample, however, we also found a significant decline in the mean level of impulsivity over this interval (Roberts et al., 2006). This finding is consistent with research on personality development over the life span, which reveals that personality traits, although relatively stable in a rank-order sense, are also dynamic constructs that change over time (Caspi et al., 2005).

Beyond replication of these developmental trends, the current study adds to the knowledge of impulsivity by demonstrating that men and women who obtained help for a longer duration showed larger declines in impulsivity. This finding extends prior results from this project overall, which has shown that a longer duration of treatment or AA is associated with better alcohol-related outcomes (Moos and Moos, 2006). A key question that arises from the current finding is how AA or treatment promotes change in an individual's impulsive tendencies. As noted earlier, significant life changes in jobs and relationships are often accompanied by expectations for how individuals should act in their new social roles, such as being more conscientious and responsible and less impulsive. Similarly, AA and other interventions for AUDs often promote greater structure and organization in daily routines, as well as encourage increased affiliation with abstinent peers and involvement in an array of prosocial activities (Moos, 2007, 2008). By fostering such lifestyle changes, ongoing participation in the social roles and interactions inherent in AA and other AUD treatments may press for a reduction in one's impulsive inclinations. In general, this conceptualization conforms to a sociogenomic perspective of personality, which posits that systemic environmental changes throughout the life span can shape personality functioning (Roberts and Jackson, 2008).

### *Mean-level declines in legal problems: Role of AA duration and decreased impulsivity*

Consistent with the normative trend of desistance in criminality throughout adulthood (e.g., Blumstein et al., 1988), legal problems declined over 16 years for both men and women. Moreover, at all assessment points, men reported significantly more legal problems than women, although legal problems in men and women declined over time at a similar rate. The current findings are consistent with a larger body of research demonstrating the benefit of AA participation for a range of outcomes that extend beyond those directly related to drinking (Humphreys et al., 2004; Tonigan et al., 1996). Notably, the moderation of this association via gender was consistent with findings of Mann and colleagues (2006), in that the relationship between longer participation in AA and fewer legal problems was significant for men only. This gender difference may indicate that men derive more benefit from participation in AA than women in terms of reducing legal problems. This difference also may reflect the fact that men had more legal problems than women and thus had more potential to improve and benefit from AA participation. In a similar fashion, a longer duration of AA was associated with fewer legal problems among individuals who were more impulsive at baseline, a finding that is consistent with the idea that the benefits of an intervention may be more pronounced for those who have more severe problems (Chen et al., 2006).

We also identified an important association between a decline in impulsivity and a decline in legal problems. This association was robust across all periods and assessments, suggesting that a decline in impulsivity among individuals with AUDs may have effects on critical outcomes that are empirically and theoretically linked to these traits. Consistent with this perspective, changes in several traits related to a broadly defined personality dimension of disinhibition (e.g., impulsivity, low conscientiousness, low constraint) have been shown to predict mortality, divorce, occupational attainment,

and other consequential outcomes over the life course (Ozer and Benet-Martinez, 2006; Roberts et al., 2007).

*Implications for treatment planning for alcohol use disorders*

In conjunction with the notion of impulsivity as a vulnerability marker for AUDs and other substance use disorders (Verdejo-Garcia et al., 2008), the current findings call for greater incorporation of assessments of impulsivity and other individual differences in treatment planning (Harkness and Lilienfeld, 1997). Although impulsivity is typically studied as a predictor of response to treatment (Poling et al., 2007), the notion that impulsivity, or personality traits in general, can be altered by a therapeutic intervention has been either dismissed or ignored in the literature. Indeed, only a few studies have provided evidence of change in personality traits over the course of therapy, and these studies have focused primarily on neuroticism (e.g., DeFruyt et al., 2006).

The misconception that personality traits cannot be altered by therapy may derive partly from evidence of moderate heritability for virtually all aspects of personality including impulsivity (Tellegen et al., 1988). However, heritability does not belie malleability. The concept of a "reaction range" for genotypes (Gottesman, 1963) implies that phenotypic expression of genes can be modified by environmental factors. Furthermore, a major source of stability in personality involves "niche picking," in which individuals actively select situations that are consistent with their trait dispositions. From this perspective, interventions may work best by assisting individuals in finding more socially constructive outlets for their trait dispositions and suggesting alternative ways of expressing their risk-taking or thrill-seeking proclivities. In other words, a focus on "characteristic adaptations" rather than "basic tendencies" may prove most beneficial in treatment (McCrae and Costa, 1995). These implications notwithstanding, the relative long-term stability of impulsivity suggests that AA and other comparable interventions may have limits in terms of how much they can alter these traits (Zinbarg et al., 2008). Hence, ongoing adherence to lifestyle changes may be required to maintain long-term changes in personality.

*Limitations and future directions*

Several limitations to the present study must be acknowledged. First, this study employed a naturalistic design rather than a randomized controlled trial. Thus, participation in AA and treatment represented "real-world" receipt of help rather than standardized interventions. Moreover, the comparability of treatment experiences across participants in terms of intensity, learned skills, and other factors is unknown. More important, as a result of the observational nature of the study, inferences regarding the causal influence of AA or treatment on impulsivity and legal problems must be tempered, because it is unclear how much the findings could be accounted for by selection factors, motivation, or other intervening variables. In the current design we controlled for some of these factors, including changes in drinking patterns, as well as baseline values of impulsivity, legal problems, and relevant demographics—thus increasing our confidence in the ability of participation in AA and changes in impulsivity to predict legal outcomes above and beyond pretreatment factors or intervening variables. Nonetheless, other spurious (unmeasured) variables still may be present.

Second, there is good support for the reliability and validity of short-term, self-reported involvement in AA and treatment (Adair et al., 1996; Tonigan et al., 2002). However, the accuracy of longer term reports of involvement in these modalities of help may be more limited. Relatedly, we cannot determine with certainty whether involvement in AA actually preceded changes in impulsivity. Hence, we can conclude only that involvement in AA and declines in impulsivity were correlated over this period.

Third, our measure of impulsivity was limited to a brief self-report scale from a relatively established inventory rather than a contemporary measure such as the NEO-Personality Inventory (Costa and McCrae, 1992) or the Multidimensional Personality Questionnaire (Tellegen, in press). Future studies may benefit from including these broadband measures of personality that comprise other personality correlates of AUDs, such as negative emotionality (e.g., aggression, alienation, disagreeableness). Furthermore, it may behoove the authors of future investigations to use multiple informants to help detect "blind spots" for which individuals lack sufficient insight into their behavioral tendencies (Grove and Tellegen, 1991).

Fourth, although significant, the effect sizes for AA in relation to impulsivity and legal problems were fairly small, suggesting that the potential for participation in AA to influence these outcomes may be modest. Nevertheless, relatively modest effect sizes are to be expected for variables such as impulsivity that have multiple determinants (Ahadi and Diener, 1989). Furthermore, it is important to note that even modest effect sizes can have substantial implications for crucial life outcomes (e.g., longevity) because of their cumulative effects across an individual's life span (Funder, 2004; Meyer et al., 2001; Rosenthal, 1990; Rosenthal and Rubin, 1982). This last issue is all the more critical, given that impulsivity is linked to an array of problematic outcomes, including numerous forms of externalizing psychopathology (e.g., AUDs, drug use disorders, child and antisocial behavior, impulse control disorders; Krueger et al., 2002). In other words, even small effect sizes associated with reductions in this trait are noteworthy.

Finally, regression to the mean may have played a role in the observed changes in impulsivity and legal problems at the follow-up assessments (Finney, 2007). However, an ex-

tensive literature exists on mean- and individual-level change in impulsivity over time—some of which has used the reliable change index, which accounts for regression to the mean (Christensen and Mendoza, 1986). In addition, there is robust evidence of an association between increasing age and a decline in criminal and legal problems across a host of social and cultural factors. Hence, observed changes in impulsivity and legal problems in our sample are not likely to simply be statistical artifacts. Importantly, the association between age and declines in impulsivity and legal problems does not call our findings into question, given that age was controlled for in the analyses.

In terms of future directions, it will be valuable to examine whether other outcomes of AUDs (e.g., symptoms of dependence, relapse) are similarly associated with changes in impulsivity and whether such traits mediate the influence of other predictors on these outcomes. For example, McKellar et al. (2008) noted that improvements in impulsivity predicted increases in alcohol-related self-efficacy—one of the strongest predictors of relapse and abstinence in substance use treatment (Ilgen et al., 2005). Further exploration into the impact of impulsivity on alcohol-related outcomes as well as other consequential life outcomes (e.g., mortality, divorce, occupational status) may be warranted.

The present study is among the first to investigate the influence of AA and professional treatment on impulsivity and the association between changes in impulsivity and legal problems. Although modest in magnitude, our findings are novel and support a dynamic view of impulsivity and related trait constructs. Potentially, these findings may heighten clinicians' and researchers' awareness of the notion that impulsivity and other personality constructs are somewhat mutable and deserve greater attention in future treatment-outcome studies of AUDs and other substance use disorders.

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